TRITIUM IN FLOW FROM SELECTED SPRINGS THAT DISCHARGE TO THE SNAKE RIVER, TWIN FALLS-HAGERMAN AREA, IDAHO, 1994-99

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CONTENTS

FIGURES

TABLES

CONVERSION FACTORS AND OTHER ABBREVIATED UNITS

Multiply	By	To Obtain
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
square mile (mi^2)	2.590	square kilometer
curie (Ci)	3.7x1010	becquerel
picocure per liter (pCi/L)	0.037	becquerel per liter
gallon (gal)	3.785	liter

Temperature can be converted from degrees Celsius (°C) to degrees Fahrenheit (°F) by the equation: °F = (°C × 1.8) + 32.

Tritium in Flow from Selected Springs that Discharge to the Snake River, Twin Falls-Hagerman Area, Idaho, 1994-99

By Brian V. Twining

Abstract

During 1994–99, the U.S. Geological Survey, in cooperation with the U.S. Department of Energy, collected samples for tritium analyses from 19 springs along the north side of the Snake River near Twin Falls and Hagerman, Idaho, to address public concern over migration of approximately 31,000 Ci of tritium discharged in wastewater at the Idaho National Engineering and Environmental Laboratory (INEEL). Evaluating tritium for the Twin Falls-Hagerman area is part of a long-term project to monitor water quality of springs discharging from the Snake River Plain aquifer downgradient from the INEEL. Routine and two quality-assurance replicate samples have been collected annually since 1990 as part of the U.S. Geological Survey's quality-assurance program.

The springs were characterized on the basis of their locations and tritium concentrations: Category I, II, and III. The differences in tritium concentrations in Category I, II, and III springs are a function of the ground-water flow regimes, land uses, and irrigation practices in and hydraulically upgradient from each category of springs. Tritium concentrations during the 1994–99 water years ranged from a low 6.5±0.6 picocuries per liter (pCi/L) to a high of 65.0±4.5 pCi/L. During 1999, tritium concentrations in the 19 springs ranged from 6.5±0.6 pCi/L to 46.1±3.2 pCi/L. Mean annual tritium concentrations measured from 1990 to 1999 in selected springs from each category show decreasing trends in tritium values, likely the result of natural isotope decay.

INTRODUCTION

Concern has been expressed that some of the approximately 31,000 Ci of tritium discharged in wastewater to the Snake River Plain aquifer at the Idaho National Engineering and Environmental Laboratory (INEEL) has migrated or will migrate to the Snake River in the Twin Falls-Hagerman area (fig. 1). The INEEL, located about 100 mi northeast of Twin Falls and about 110 mi northeast of Hagerman, comprises 890 mi^2 of the northeastern part of the eastern Snake River Plain (ESRP) and overlies the ESRP aquifer. Injection wells at INEEL were used regularly until 1984 and infiltration ponds continue to be used to dispose of wastewater that could contain radioactive and chemical contaminants. Ground water downgradient from the INEEL is used for drinking, irrigation, and aquaculture.

An extensive monitoring network is maintained by the USGS to collect geohydrologic, hydraulic, geochemical, and radioisotope data at and downgradient from the INEEL. This continuing monitoring program provides information needed to inform the public to prevailing water-quality conditions in the aquifer system and to support the current and planned geohydrologic research that could help water-resource managers resolve issues that concern the migration and disposition of radioactive and chemical wastes.

Radioactive and chemical wastes have migrated as much as 13 mi southwest of the disposal areas at the INEEL (Bartholomay and others, 2000). Tritium was detected intermittently at concentrations of 3,400±200 pCi/L or less in water from three wells along the southern boundary of the INEEL between 1983 and 1985 (Pittman and others, 1988). From April 1985 to October 1995, tritium concentrations in water from wells near the southern boundary of the INEEL were less than the laboratory minimum reporting level (Bartholomay and others, 1997); however, in 1998, because of lower laboratory detection limits used, tritium concentrations in water from one well at the boundary and one well south of the boundary exceeded the

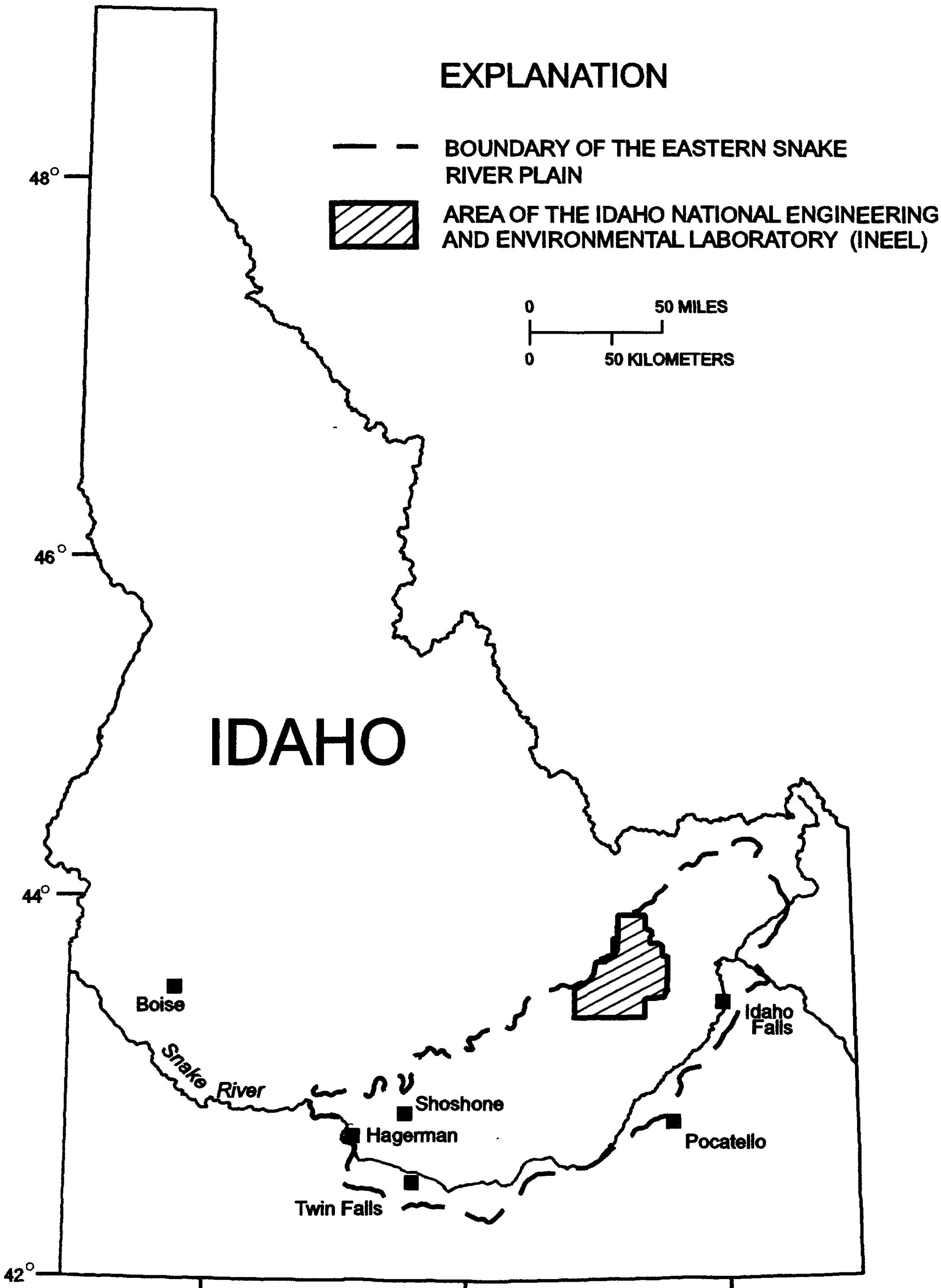

Figure 1. Location of the study area, between the Idaho National Engineering and Environmental Laboratory and Hagerman, Idaho.

reporting level and were 310±60 and 300±60 pCi/L, respectively (Bartholomay and others, 2000).

Tritium, a radioactive isotope of hydrogen, is a naturally occurring isotope with a 12.3-year half-life and is produced by reaction of cosmic rays with nitrogen in the upper atmosphere (Walker and others, 1989). It also is a radioactive waste product from nuclear power plant operations, fuel processing, and weapons production and testing. Before atmospheric testing of nuclear weapons in the 1950's and 1960's, the average background tritium concentration in environmental waters from cosmic-ray production was less than 16 pCi/L (National Council on Radiation Protection and Measurements, 1979). Atmospheric weapons tests markedly increased tritium concentrations in precipitation and surface water. In 1963, the mean concentration of tritium in surface water of the United States was about 3,500 pCi/L. By 1990, however, the mean concentration in surface water was about 65 pCi/L (R.L. Michel, USGS, oral commun., 1992). For comparison, the maximum contaminant level for tritium in public drinking-water supplies is 20,000 pCi/L (U.S. Environmental Protection Agency, 1983, p. 236).

This study is part of a long-term project, established by the U.S.Geological Survey (USGS) in cooperation with the U.S. Department of Energy, to monitor tritium concentrations in spring discharge to the Snake River in the Twin Falls-Hagerman area. Since 1989, water samples have been collected from 19 springs along the north side of the Snake River in this area. This report documents tritium concentrations in samples from spring flow collected during 1994–99 from the Twin Falls-Hagerman area. Additionally, tritium data from 1990–93 will be evaluated within this report taken from Mann and Low (1994).

Geohydrologic Setting

The ESRP aquifer is the major aquifer in southeastern Idaho and includes an area of approximately 15,600 mi^2 and is about 200 mi long and 50 to 70 mi wide. The aquifer extends from Dubois, Idaho, southwest to the main discharge area near Twin Falls, Idaho (fig. 1). The general direction of ground-water movement within the ESRP is from the northeast to southwest. Concentrations of chlorine-36 indicate that the average ground-water flow velocity is at least 10 ft/day for the Snake River Plain aquifer (Cecil and others, 2000). Sources of recharge to the aquifer include infiltration from irrigation, rainfall, and valley underflow.

The ESRP is underlain by a layered sequence of basaltic lava flows and cinder beds intercalated with alluvium and lakebed sedimentary deposits. Individual lava flows generally range from 10 to 50 ft in thickness, and average 20 to 25 ft in thickness (Mundorff and others, 1964, p. 143). Locally, rhyolitic lava flows and tuffs are exposed at the land surface or occur at depth. The sedimentary deposits consist mainly of lenticular beds of sand, silt, and clay with lesser amounts of gravel. The basaltic lava flows and intercalated sedimentary deposits combine to form the Snake River Plain aquifer, which is the main source of ground water to the ESRP. Irrigation is the primary use of ground water in this region (Mann and Low, 1994).

Acknowledgments

The author gratefully acknowledges the following employees of the USGS who collected the water samples and made field measurements of pH, specific conductance, and temperature: Betty J. Tucker, Michael .J. Greene, and Roy C. Bartholomay. The author would also like to express appreciation to land owners and spring owners for allowing the USGS to collect samples. Special gratitude is owed to USGS hydrologists Roy C. Bartholomay, LeRoy L. Knobel, and Deborah Parliman for their reviews and constructive comments of this report.

METHODS AND QUALITY ASSURANCE

Methods used to collect and analyze water samples for tritium generally followed guidelines established by the USGS (Wood, 1976; Thatcher and others, 1977; and Wilde and others, 1998). Sampling methods used in the field and the method used to report tritium concentrations are outlined in the following sections.

Samples collected during 1994–99 were analyzed using an electrolytic-enrichment, gas-counting method with an analytical method detection limit of 0.3 pCi/L and a 360- to 1,200-minute counting period. This method primarily is limited to the analyses of samples that contain concentrations of tritium between 0.2 and 100 pCi/L (Pritt and Jones, 1989, p. 5-19).

Sample Collection

Water samples for tritium analyses were collected in 1-L polyethylene bottles and were not treated before or after being bottled in the field. Samples were collected as close as reasonably possible to the spring orifices. Some springs had multiple orifices or the flow was diverted for use by fish hatcheries. Where possible, the samples were collected upstream from diversions. The 1-L polyethylene bottle was lowered by hand in the area of the orifice or in the channel downstream from the orifice(s). Where flow was channeled, care was taken to sample flowing discharge; water in eddies and ponded areas was avoided. The bottle was rinsed at least three times with spring water before sample collection. After collection, the bottle immediately was capped, and the exterior was dried; laboratory film was placed around the cap, and a label that included identification information for the sample was attached to the bottle. The samples were documented and placed in a secured vehicle or in the USGS INEEL Project Office until they were shipped to the USGS National Water Quality Laboratory (NWQL).

Physical conditions, temperature, pH, and specific conductance at the springs during sample collection were measured and recorded in a field logbook. A chain-of-custody record was used to track the samples from the time of collection until delivery to the analyzing laboratory. These records are available for inspection at the USGS INEEL Project Office.

Reporting of Data

For each tritium concentration, an associated analytical uncertainty, 2s, was calculated such that there was a 95-percent probability that the true tritium concentration in a sample was in the range of the reported concentration plus or minus the analytical uncertainty. For example, given an analytical result of 11.0±1.0 pCi/L, there is a 95-percent probability that the true concentration is in the range of 10.0 to 12.0 pCi/L.

Quality Assurance

Detailed descriptions of internal quality control (QC) and overall quality-assurance (QA) practices used by the NWQL are provided in reports by Friedman and Erdmann (1982), Jones (1987), and Pritt and Raese (1995). Water samples analyzed by the NWQL were collected in accordance with a quality-assurance plan for quality-of-water activities conducted by personnel at the INEEL Project Office. The plan was finalized in June 1989, revised in March 1992 and in 1996 (Mann, 1996), and is available for inspection at the USGS INEEL Project Office.

Approximately 10 percent of the water samples were quality-assurance replicate samples, two of which were collected each year of sampling. Replicate sample concentrations were similar to corresponding spring data at each site. Differences between replicate samples were small enough to suggest that sampling/analytical variations do not affect the spring classifications and trends presented in this report.

TRITIUM IN FLOW FROM SELECTED SPRINGS

During 1994–99, water samples were collected from 19 springs (fig. 2). For ease of discussion, the springs were categorized on the basis of their locations and tritium concentrations as described by Mann and Low (1994) (fig. 2 and table 1). Category I springs, the springs farthest upstream, include Devils Washbowl, Devils Corral (upper), Unnamed Spring No. 2 above Shoshone Falls, Blue Lakes, Warm Creek, and Crystal Springs. Tritium concentrations in the flow from these springs were markedly greater than concentrations in flow from downstream springs. Category II springs include Clear Lakes, Briggs Creek, Banbury, Unnamed Spring between Blind and Banbury near Buhl, Blind Canyon, Box Canyon, Blue Heart, Sand, Thousand, Bickel, Riley Creek, and Billingsley Creek Springs. Category III consists of Birch Creek Spring, at which the tritium concentration was less than the concentration in Category I springs, but greater than the concentrations in Category II springs. Physical and chemical characteristics of and tritium concentrations in water samples for the 19 springs are presented in table 2.

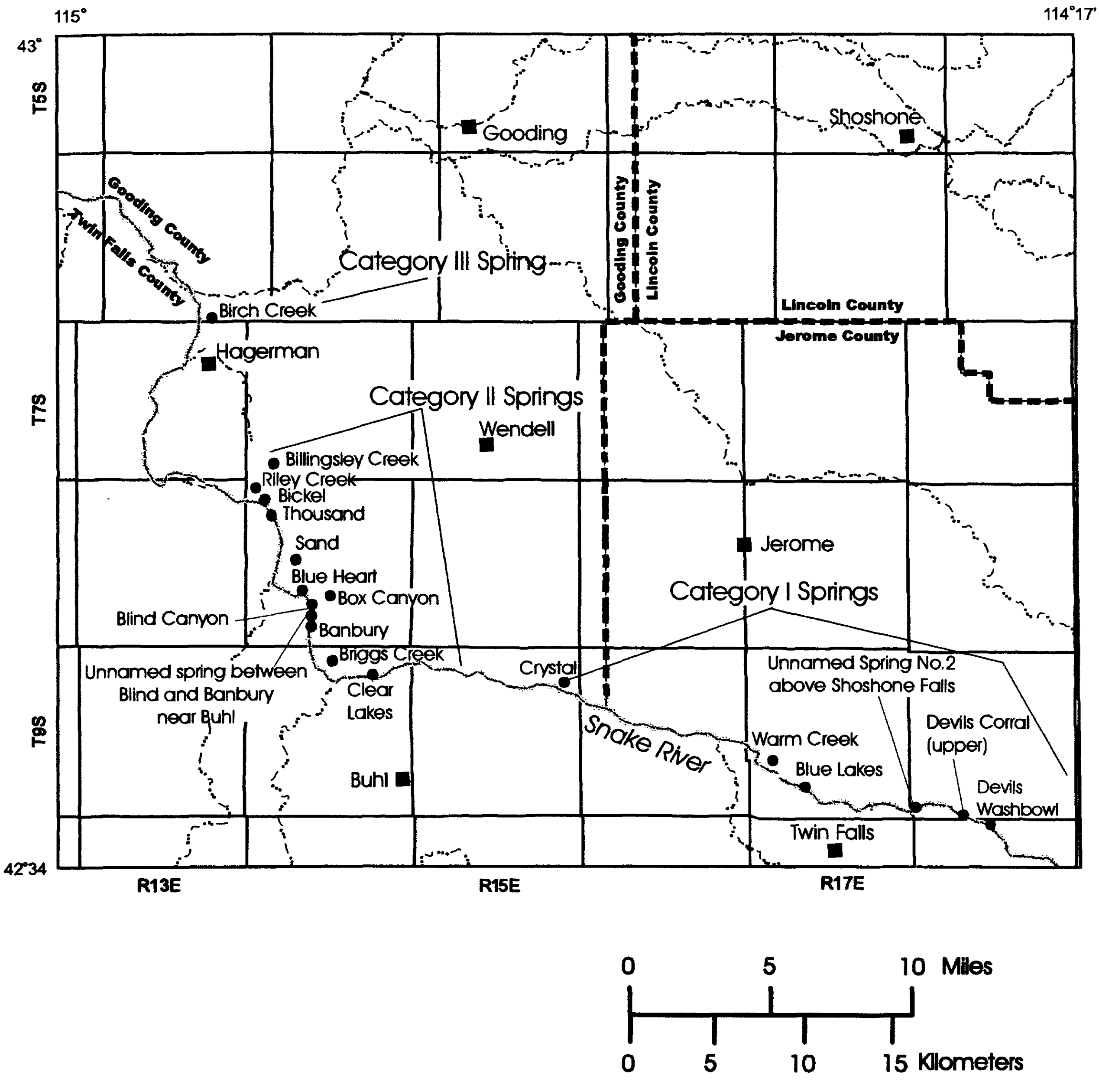

Figure 2. Locations of springs where water samples were collected for tritium analyses, Twin Falls-Hagerman area, Idaho, 1994–99.

Table 1. Springs where water samples were collected for tritium analyses, Twin Falls-Hagerman area, Idaho, 1994–99

[Springs are listed in downstream order; see figure 2 for locations]

	Category I Springs	
Devils Washbowl	Unnamed Spring No.2 above Shoshone Falls	Warm Creek
Devils Corral (upper)	Blue Lakes	Crystal
	Category II Springs	
Clear Lakes	Blind Canyon	Thousand
Briggs Creek	Box Canyon	Bickel
Banbury	Blue Heart	Riley Creek
Unnamed spring between Blind and Banbury	Sand	Billingsley Creek
	Category III Spring	
Birch Creek		

Table 2. Physical and chemical characteristics of and tritium concentrations in water from selected springs in the Twin Falls-Hagerman area, Idaho, 1994–99

[See figure 2 for locations of springs and table 1 for their downstream order. Tritium concentrations and analytical uncertainties, in picocuries per liter,determined by U.S. Geological Survey's National Water Quality Laboratory, Arvada, Colo.; analytical uncertainties reported as 2s. Time, in military units; temperature, in degrees Celsius; ph, negative base-10 logarithm of hydrogen ion activity in moles per liter; specific conductance, in microsiemens per centimeter at 25 degrees Celsius. Remarks: Replicate indicates a second sample was submitted for analysis. Abbreviations: nr, near; NA, temperature was not measured]

Spring(s) name	Date sampled	Time	Temperature	pH	Specific conductance	Tritium concentration and analytical uncertainty	Remarks
			Category I Springs				
Blue Lakes	3/09/94	1030	15.8	8.0	632	58.0±3.8	
Outlet nr Twin Falls	3/28/95	0945	15.4	7.8	629	47.0±3.2	
	3/13/96	0845	15.8	7.6	621	48.0±3.2	
	3/17/97	1455	15.6	8.2	623	45.4±3.2	
	3/09/98	1520	15.6	7.9	620	44.8±3.2	
	3/15/99	1515	15.2	7.9	615	38.4±2.6	
Crystal Springs	3/09/94	1215	14.7	8.2	698	53.0±3.8	
nr Buhl	3/28/95	1130	14.3	8.2	696	49.0±2.6	
	3/12/96	1215	14.7	8.3	695	47.0±3.2	
	3/17/97	1325	14.5	8.3	702	46.4±3.2	
	3/09/98	1420	14.5	8.2	696	44.8±3.2	
	3/15/99	1725	14.1	8.0	687	39.7±2.6	
Devils Corral	3/07/94	1045	14.6	7.9	640	61.0±3.8	
(Upper Outlet)	3/27/95	1220	15.1	8.5	633	55.0±2.6	
nr Kimberly	3/12/96	1030	15.0	7.8	603	52.0±3.2	
	3/19/97	0900	15.0	8.0	655	46.4±3.2	
	3/11/98	0845	14.6	8.0	636	50.2±3.2	
	3/15/99	0935	15.1	8.1	629	44.5±3.2	

Table 2. Physical and chemical characteristics of and tritium concentrations in water from selected springs in the Twin Falls-Hagerman area, Idaho, 1994–99—Continued

Spring(s) name	Date sampled	Time	Temper-ature	pH	Specific conductance	Tritium concentration and analytical uncertainty	Remarks
			Category I Springs—continued				
Devils Washbowl	3/07/94	0820	12.7	8.1	664	65.0±4.5	
Spring nr Kimberly	3/27/95	0910	12.6	8.5	652	55.0±3.8	
	3/12/96	1245	14.5	8.4	614	57.0±3.8	
	3/19/97	1150	15.1	8.7	645	53.4±3.8	
	3/11/98	1035	13.6	8.4	649	51.8±3.2	
	3/15/99	1145	13.6	8.2	644	46.1±3.2	
						44.8±3.2	Replicate
Unnamed Spring	3/12/96	0800	12.8	8.1	604	50.0±3.2	
No 2 above	3/18/97	1530	16.2	8.3	615	47.4±3.2	
Shoshone Falls	3/10/98	1440	14.0	8.3	613	44.8±3.2	
	3/15/99	1410	13.4	8.0	613	39.4±2.6	
Warm Creek	3/09/94	0930	15.2	7.8	648	56.0±3.8	
at Perrine Ranch	3/28/95	0855	15.3	7.9	646	54.0±3.8	
nr Twin Falls	3/13/96	0945	15.7	7.9	632	46.0±3.2	
	3/17/97	1550	15.4	8.0	631	44.5±3.2	
						46.4±3.2	Replicate
	3/09/98	1605	15.4	7.8	627	44.2±3.2	
	3/15/99	1600	15.1	7.7	624	40.3±2.6	
			Category II Springs				
Banbury	3/09/94	1045	12.7	9.1	434	11.0±1.0	
Spring nr Buhl	3/28/95	1315	13.9	8.8	422	9.1±0.8	
	3/11/96	1030	14.0	7.9	436	8.7±0.6	
	3/18/97	1010	13.3	8.5	447	9.2±0.6	
	3/10/98	0915	12.5	8.4	437	8.1±0.6	
						7.9±0.6	Replicate
	3/16/99	1020	12.4	8.5	428	7.1±0.6	
Bickel Spring	3/07/94	1334	15.7	8.4	329	9.7±0.8	
nr Hagerman	3/27/95	1300	15.4	8.3	330	8.7±0.6	
	3/11/96	1215	15.7	8.3	327	8.1±0.6	
	3/17/97	1010	15.0	8.3	337	7.7±0.6	
	3/09/98	1020	NA	8.2	329	7.9±0.6	
	3/16/99	1448	14.8	8.4	329	6.5±0.6	
Billingsley Creek	3/07/94	1200	13.1	8.2	372	13.0±0.8	
nr Hagerman	3/27/95	1124	13.4	8.2	388	12.0±0.9	
	3/11/96	1010	13.9	8.1	378	10.0±0.7	
	3/17/97	0905	14.8	7.8	357	8.6±0.6	
						8.8±0.8	Replicate
	3/09/98	0920	14.0	7.8	353	9.3±0.8	
	3/16/99	1400	14.6	8.3	347	6.9±0.6	

Table 2. Physical and chemical characteristics of and tritium concentrations in water from selected springs in the Twin Falls-Hagerman area, Idaho, 1994–99—Continued

Spring(s) name	Date sampled	Time	Temper-ature	pH	Specific conductance	Tritium concentration and analytical uncertainty	Remarks
			Category II Springs—continued				
Blind Canyon	3/09/94	0845	11.5	8.6	452	9.2±0.8	
Spring nr	3/28/95	1430	13.7	8.5	457	9.6±0.9	
Buhl	3/11/96	1230	14.5	8.4	463	9.4±0.6	
						9.8±0.7	Replicate
	3/18/97	1130	14.0	8.4	451	8.8±0.6	
	3/10/98	1105	12.4	8.6	537	9.7±0.6	
	3/16/99	1130	12.1	8.7	537	8.6±0.7	
Blue Heart Spring	3/09/94	1200	14.4	8.5	401	9.2±0.8	
	3/28/95	1505	14.1	8.0	393	8.1±0.8	
	3/11/96	1315	15.0	7.6	397	9.5±0.7	
	3/18/97	0950	14.4	7.9	407	7.6±0.6	
	3/10/98	0845	14.4	7.7	409	7.2±0.6	
	3/16/99	0955	14.1	8.2	398	6.9±0.6	
Box Canyon	3/08/94	1030	14.3	7.6	404	11.0±0.7	
Spring nr Wendall						10.0±0.7	Replicate
	3/29/95	0900	14.0	8.3	426	10.0±0.8	
	3/12/96	1100	14.6	8.2	424	9.5±0.7	
	3/18/97	1355	15.0	8.2	431	9.3±0.6	
	3/09/98	1150	14.3	8.1	416	8.5±0.6	
	3/16/99	1615	13.8	8.1	417	8.1±0.6	
Briggs Creek	3/07/94	1456	14.3	7.8	487	13.0±0.9	
Spring nr Buhl						12.0±0.8	Replicate
	3/28/95	1330	14.1	7.9	496	12.0±0.8	
	3/12/96	0900	14.3	7.9	495	12.0±0.8	
	3/17/97	1155	14.1	7.9	512	11.5±0.8	
	3/09/98	1245	14.1	7.7	489	10.1±0.6	
	3/16/99	1740	13.7	7.8	487	9.0±0.7	
Clear Lakes	3/08/94	1445	14.0	7.3	475	13.0±1.0	
Outlet nr Buhl	3/29/95	1125	13.7	8.0	454	10.0±0.8	
	3/13/96	0830	13.9	7.7	461	12.0±1.0	
	3/17/97	1225	14.1	8.0	495	10.7±0.7	
	3/09/98	1310	14.2	7.9	478	10.5±0.7	
	3/16/99	1710	13.7	8.0	504	10.6±0.7	
Riley Creek	3/07/94	1405	15.5	8.1	333	11.0±0.7	
below Lewis Creek	3/27/95	1330	15.4	8.3	332	8.7±0.6	
nr Hagerman	3/11/96	1300	15.7	8.2	331	8.8±0.8	
						8.3±0.6	Replicate
	3/17/97	0945	14.8	8.1	334	7.2±0.6	
	3/09/98	0950	14.1	8.0	330	9.4±0.7	
	3/16/99	1425	14.8	8.3	331	7.4±0.6	

Table 2. Physical and chemical characteristics of and tritium concentrations in water from selected springs in the Twin Falls-Hagerman area, Idaho, 1994–99—Continued

Spring(s) name	Date sampled	Time	Temperature	pH	Specific conductance	Tritium concentration and analytical uncertainty	Remarks
			Category II Springs—continued				
Sand Springs nr Hagerman	3/08/94	1300	14.0	7.9	380	11.0±0.7	
						10.0±0.7	Replicate
	3/27/95	1420	14.2	7.9	397	11.0±1.0	
	3/11/96	1400	14.5	7.9	400	7.6±0.8	
	3/17/97	1100	14.3	8.0	415	8.6±0.6	
	3/09/98	1100	14.2	7.9	405	7.3±0.6	
	3/16/99	1535	13.9	7.9	397	6.6±0.6	
Thousand Springs nr Hagerman	3/08/94	0915	12.1	7.1	380	12.0±0.8	
						12.0±0.8	Replicate
	3/28/95	1545	14.5	8.3	371	11.0±0.8	
	3/11/96	1345	15.0	8.0	376	10.0±0.8	
	3/18/97	0920	14.1	8.1	387	9.3±0.6	
	3/10/98	1235	15.1	8.3	370	8.6±0.6	
	3/16/99	1220	14.4	8.5	366	8.6±0.7	
Spring btwn Blind and Banbury nr Buhl	3/09/94	0950	12.4	8.7	446	11.0±0.8	
	3/28/95	0955	12.0	8.6	433	9.5±0.7	
	3/11/96	1100	14.0	8.2	436	9.7±1.0	
	3/18/97	1035	13.6	8.5	450	10.0±0.6	
	3/10/98	1020	13.0	8.4	435	8.6±0.6	
	3/16/99	1045	12.9	8.5	431	8.0±0.6	
						7.4±0.6	Replicate
			Category III Spring				
Birch Creek nr Hagerman	3/07/94	0949	13.2	8.2	449	30.0±1.9	
	3/27/95	0955	13.3	8.4	442	26.0±1.5	
	3/11/96	0930	14.3	8.4	446	24.0±1.4	
	3/17/97	0810	13.2	7.9	447	21.9±1.5	
	3/09/98	0835	12.8	8.3	435	22.3±1.5	
						21.3±1.4	Replicate
	3/16/99	1325	13.9	8.4	441	20.5±1.3	

Mann and Low (1994) indicated that the differences in tritium concentrations in Category I, II, and III springs are a function of the ground-water flow regimes, land uses, and irrigation practices in and hydraulically upgradient from each spring. In 1959, Mundorff and others (1964, p. 4) concluded that part of the ground water discharged to Category I springs originates in areas a few tens of miles east of Twin Falls, near Burley and Lake Walcott; their conclusion was based on a water-table map and a flow-net analysis of the Snake River Plain aquifer. The configuration of the water table in the spring of 1980, as described by Lindholm and others (1988), also supports this conclusion. In contrast, part of the ground water discharged to Category II springs originates in areas near Dubois and Rexburg, about 140 mi northeast of Twin Falls, and part of the water discharged to the Category III spring originates in the Big and Little Wood River basins.

For the years 1994–99, tritium concentrations in flow from all 19 springs along the north side of the Snake River ranged from 6.5±0.6 to 65.0±4.5 pCi/L (table 2) and averaged 21.7 pCi/L; the standard error of estimate for the mean concentration was 1.5 pCi/L. Flow from Category I springs contained larger concentrations of tritium than flow from downstream springs. Tritium concentrations in flow from Category I springs ranged from 38.4±2.6 to 65.0±4.5 pCi/L and averaged 48.5 pCi/L with a standard error of estimate for the mean concentration of 3.3 pCi/L. In contrast, concentrations in flow from Category II springs ranged from 6.5±0.6 to 13.0±1.0 pCi/L and averaged 9.4 pCi/L; the standard error of estimate for the mean concentration was 0.71 pCi/L. Flow from the Category III spring contained smaller concentrations of tritium than Category I springs, and larger concentrations than Category II springs. Tritium concentrations in water samples from the Category III spring ranged from 20.5±1.3 to 30.0±1.9 pCi/L, respectively; the average concentration was 23.7 pCi/L and the standard error for the mean was 1.5 pCi/L.

Decreasing tritium concentrations in springs sampled in the Twin Falls-Hagerman area were first described by Mann and Low (1994). Figure 3 shows tritium concentrations in three selected springs (Blue Lakes, Banbury Spring, and Birch Creek Spring) for the years 1990–99. During that period, mean annual tritium concentrations decreased about 5 percent per year. Tritium data for 1990–93 sample period can be found in Mann and Low (1994, p. 8). During 1990–99 sample period, tritium concentrations for the Category I spring (Blue Lakes) decreased from a high of 65.3±4.5 in 1990 to a low of 38.4±2.6 pCi/L in 1999 (table 2); concentrations in the Category II spring (Banbury) decreased from a high of 14.7±1.0 in 1990 to a low of 7.1±0.6 pCi/L in 1999 (table 2); concentrations in the Category III spring (Birch Creek) decreased from a high of 47.7±3.2 in 1990 to a low of 20.5±1.3 pCi/L in 1999 (table 2). The decreasing tritium values are likely the result of natural isotope decay resulting from the short half-life of tritium of 12.3 years (Walker and others, 1989).

SUMMARY

Concern has been expressed that some of the 31,000 Ci of tritium in wastewater discharged to the Snake River Plain aquifer at the INEEL since the 1950's could migrate to the Snake River in the Twin Falls-Hagerman area. Water downgradient from the INEEL is used for drinking, irrigation, and aquaculture. Nineteen springs along the north side of the Snake River were sampled annually during 1994–99, as part of a long-term project to monitor water quality of springs discharging from the Snake River Plain aquifer downgradient from the INEEL. During 1994–99, tritium concentrations ranged from 6.5±0.6 to 65.0±4.5 pCi/L. On the basis of their locations and tritium concentrations, the springs were placed into three categories: Category I springs are the farthest upstream and contained from 38.4±2.6 to 65.0±4.5 pCi/L of tritium; Category II springs are downstream from those in Category I and contained from 6.5±0.6 to 13.0±1.0 pCi/L; and Category III springs are the farthest downstream and contained from 20.5±1.3 to 30.0±1.9 pCi/L.Tritium concentrations demonstrate decreasing trends for the sample period 1990–99, likely the result of natural isotope decay.

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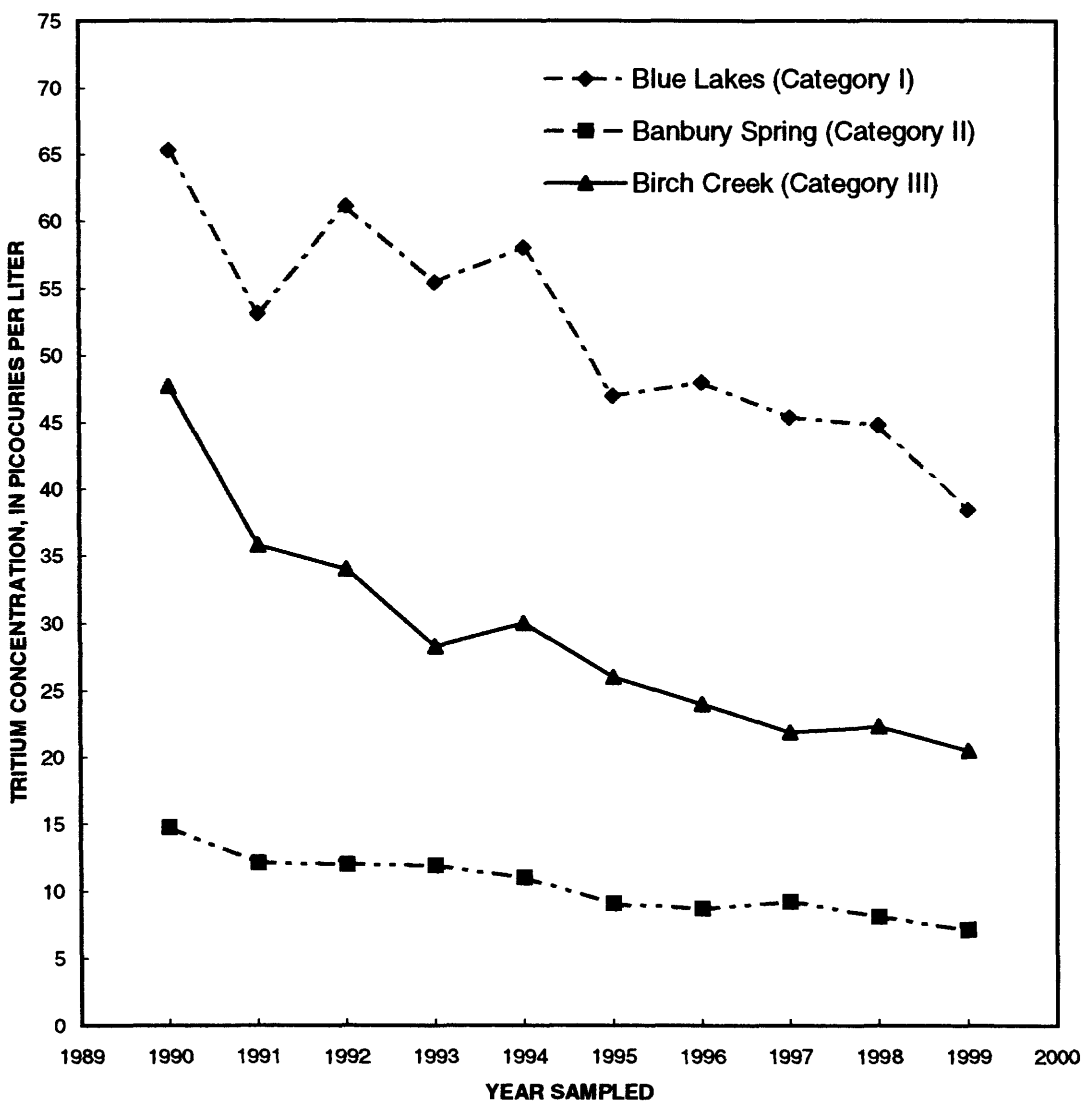

Figure 3. Concentrations of tritium in selected Category I, II, and III springs, 1990–99 (1990–93 data were taken from Mann and Low, 1994, p. 8) .

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